NOTES ON POISONING FRUIT BATS (*Epimorphus wahlbergei*).

By G. J. Jex-Blake, M.D.

The passion flower known as the Pomme d'Or, possibly *Passiflora laurifolia*, is a creeper producing a golden yellow or orange fruit the size of a hen's or goose's egg, that makes very good eating. Three plants of this are trained up the wire netting round a lawn tennis court in my garden, forming a wall 70 or 80 feet long, 8 or 9 feet high, about 2 feet thick, and nine or ten years old. During 1930 and 1931 we got much fewer pommes d'or from these plants owing to the depredations of fruit-eating bats. In 1930 I was lent a bird-catcher's net to put up round the plants and trap the bats; but, for one reason or another, none of the bats allowed themselves to be caught—possibly the net was ill set up, or too conspicuous.

In August and September, 1931, there was a good crop of fruit, but the bats were getting most of it, biting a round hole the size of a shilling—or less—in the upper part of a pomme d'or as it ripened aud turned from dark bluish green to yellow, and sucking out the contents. It was therefore decided to try and get rid of the bats by poisoning them with strychnine.

In order to accustom the bats to the idea of eating pommes d'or tied round with string and fastened to branches of the creeper instead of growing naturally, a couple of ripe fruits were thus fastened on October 12th in a natural recess in the foliage. Next morning the string was found bitten through, and the pommes d'or were lying on the ground nearby with their stalks bitten off short and faint tooth-marks visible on their surfaces; it seemed as if the rind of the ripe fruit, which certainly is very hard and elastic under the knife, was more than the bats could manage to perforate. After this a couple of fruits were fixed to the creeper with wire, and a bit of the rind the size of a shilling was cut off at the top of each to give the bats a start; and these fruits were eaten up every night from October 13th to 16th. Between October 17th and 22nd, eight pommes d'or, each containing 1 grain of strychnine hydrochloride, and four containing 3 grains of potassium cyanide each, were hung up in the creeper, two a night.

These were eaten out completely each night; a careful search for dead bats was made all round, but not one could be found, either then or later. It was suggested to me by Mr. Howse that the alkaloidal salt strychnine hydrochloride might possibly be acting as an emetic, so that the bats, after eating what would otherwise be a fatal dose of the salt, might be vomiting it all up before it had time to kill them. On his suggestion therefore the alkaloid strychnine was substituted for

its salt the hydrochloride; on October 23rd four pommes d'or each containing 3½ grains strychnine were hung up for the bats, and next morning three of these were found to have been eaten out, with a good deal of debris of rind and fruit on the ground below, and the hole cut in the fruit very much enlarged. The fourth fruit seemed to have escaped the bats' notice, but was found eaten out two days later.

On October 24th three pommes d'or, each containing 7 grains of strychnine were put up, and next day it was found that all had been eaten and that their shells had been bitten out very extensively; the same thing was noted on October 26th when it was found that four fruits, each containing 6 grains of strychnine, put up the night before, had been eaten out completely.

Two striped Nairobi mice were found dead beside the poisoned debris of fruit lying on the ground on October 24th and 26th, and these, so far as could be ascertained, were the only victims of the 59 grains of strychnine, more or less, eaten with the last 11 pommes d'or poisoned and exposed. Meanwhile the bats had become noisier than usual at night; they are difficult to see owing to the number of trees in the garden, one does not hear more than two or three squeaking in different directions at any given moment, and any estimate of their numbers is bound to be mere guess work, but I assume that there are a dozen or two in all.

Strychnine having apparently failed as a bat poison, and potassium cyanide also, corrosive sublimate—perchloride of mercury—was given a trial. On October 26th four pommes d'or, each containing 2 grains of corrosive sublimate and half a teaspoonful of sugar to conceal the taste of the poison, were wired to the creeper. Next day it was found that three of the fruits were half eaten, with some of the contents dropped on the ground. Four more were put up, each with four grains of corrosive sublimate, and next day two were found untouched, two about one-third eaten; a day later no more of the fruits had been consumed. The bats appeared to dislike their metallic flavour. The supply of pommes d'or having run short, four ripe Cape tomatoes (*Cyphomandra betacea*) were wired up in the creeper, but the bats did not seem to like them and only ate two in the course of the next four days. Bats were heard about the garden each night, and in view of the apparent failure of corrosive sublimate as a bat poison it was determined to give arsenic trioxide—white arsenic—a trial. On November 8th six pommes d'or, each containing 10 grains of white arsenic, were put up; next day only two had been touched and a little eaten, though elsewhere on the creeper the naturally growing fruits were still being devoured. By November 29 about one-third of the contents of these six fruits had been eaten, and the rest had dried up; meanwhile there seemed to be less destruction of the ripening fruits of the creeper going on; and it was assumed that the white arsenic had been the most successful of the five bat poisons tried.

During the months of December, January, and February very little was heard of bats squeaking round the house at night, but there was nothing to show whether this was due to the death of our bats, or to the fact that the garden contained no fruit for them to eat so that they did not continue to visit it.

To summarise the results so far obtained, it would seem that a number of fruit-eating bats estimated at a dozen or two, had consumed 8 grains of strychnine hydrochloride, 12 grains of potassium cyanide, very nearly 59 grains of strychnine, perhaps 6 or 7 grains of corrosive sublimate, and about 20 grains of white arsenic, between October 17th and November 29th, without our being able to find a single corpse. These are large quantities of very poisonous substances. The strychnine hydrochloride would have been enough to kill five or six human beings, the potassium cyanide three or four, the strychnine 35 or 40, the corrosive sublimate one, and the white arsenic six or seven. In the case of wild animals the fatal doses of soluble strychnine nitrate quoted by the German firm E. Merck & Co., and supplied to me by Mr. Howse are as follows:—

Lions: 12 grains.
Tigers and leopards: 6 grains.
Wolves: 4 grains.
Dingoes: 5 grains.
Foxes: ¾ grain.
Gophers: ½ grain.
Bandicoots: one-tenth grain.

These figures show that the carnivora are easily poisoned by relatively minute amounts of strychnine, and many settlers in this colony have found strychnine an excellent poison for fruit-eating birds. In order to get further light thrown on the apparent immunity of our fruit-bats to strychnine and other poisons, I wrote to a friend in London, who forwarded my letter to Mr. J. N. Ratcliffe, a zoologist who has recently spent a couple of years in tropical Australia studying the possibility of destroying the fruit bats that descend in great flocks and eat out whole orchards in that country. Mr. Ratcliffe writes of my letter as follows:—

"Your friend's findings rather amazed me. Fruit bats are a nuisance in the orchards of New South Wales, and in certain tropical fruit plantations in Queensland. Apart from shooting, the only effective action which can be taken is poison. Strychnine is used as a rule, proving very much more effective than KCN or arsenic. I have heard of more than a dozen flying foxes being poisoned on one paw-paw, and over sixty in one night on four apple trees, on which a dozen or so strychnined apples were hung. Sometimes it seems as though the mere puncturing of the skin, once the poison has permeated through the pulp, is enough to finish the bat. With this experience in my mind I have no answer to your friend's letter. The bats poisoned in the orchards very seldom fly far. In fact they are usually found next morning hanging on the baited tree.

" That a fruit bat can eat six grains of strychnine and get away with it would seem ridiculous; but your friend is quite definite on the point. The only explanation which suggests itself is that such a violent overdose induces vomiting. Yet one would have expected that this would have been noticed—had it occurred. I cannot say what would be the order of the lethal dose judging from my Australian experience. I have seen a man mix a syrup in a saucer, and in it stir ground crystals of strychnine which would just cover the last quarter-inch of a pen-knife blade, and paint this syrup over an apple—and collect two or three corpses next day, with plenty of syrup still left on the fruit, and in the saucer too for that matter."

It is clear, therefore, that in tropical Australia fruit-eating bats are readily killed by small doses—fractions of a grain—of strychnine. Taking all the facts into consideration my apparent failure to kill any bats with the large quantities of poison consumed remains an unsolved mystery.